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(57) Abstract

An elongate, tubular or cylindrical foodstuff is provided, such as a sausage, that comprises an edible proteinaceous composition that is encapsulated in an edible hardened collagen-free skin comprising a protein (e.g. casein) and a hydrocolloid (e.g. alginate). Also disclosed is a process for making such a foodstuff, by coating the proteinaceous composition with a skin-forming material, and then hardening this material by chemical or physical means. Chemical treatment includes exposure to a cross-linking or gel-forming agent, which can result in hardening by cross-linking or the formation of a gel by the protein and/or the hydrocolloid. The proteinaceous composition and skin-forming material are continuously co-extruded and passed into a bath containing a cross-linking or gel-forming agent.

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FOODSTUFF WITH SKIN CONTAINING PROTEIN AND HYDROCOLLOID

The present invention relates to elongate, tubular or cylindrical foodstuffs, such as sausages, that comprise an edible proteinaceous composition that is encapsulated in or enveloped by a skin, the skin comprising a protein and a hydrocolloid. The foodstuff is intended to be (substantially) collagen free, and can be prepared by coating a skin-forming material onto the proteinaceous composition, and then hardening the material so that it forms a skin and so encapsulates the proteinaceous composition.

Many sausages that are on the market use collagen in their skins. A collagen paste is used to cover the sausage filling or batter, and the paste heated to form a skin. However, collagen is a meat-derived product that is obtained from the bones or hides of cows or pigs. In recent years there has been an increasing move towards vegetarian or vegan diets, which has been exacerbated by the appearance of BSE (Bovine Spongiform Encephalopathy), otherwise known as "mad cow disease". It would therefore be an advantage to be able to provide a replacement for collagen in skins of foodstuffs such as sausages.

The replacement of collagen, however, is not simple because it provides several desirable properties to sausage skins. For example, in certain German sausages the collagen is responsible for customer-expected qualities such as a cracking or snapping sound when the sausage is broken in half, and the skin splits (in Germany this is referred to as "Knäckigkeit"). It can also provide a high viscosity for the composition that is to be formed into the skin. One of the aims therefore of the present invention is not only to replace collagen, but to find a collagen substitute that can still provide the desired properties in foodstuffs (such as the snapping or cracking sound "Knäckigkeit").

The replacement of collagen has been proposed before, but not because of the recent trend towards vegetarian foods. One of the first documents to advocate collagen in artificial sausage casings as a replacement for animal intestines was GB 1040770, but since then US 3682661 describes various failures of non-collagen materials (it suggests instead vegetable proteins) as does EP-A-0,244,661 (which replaces some of collagen by gluten). Other sausage casings are based on soybean protein (US 4861603, US 5620757);

cellulose (GB 1544155 and GB 761856) or carboxylic acid, plasticiser and casein (US 5681517 and DE 4309528). None of them advocate replacing all the collagen with a combination of a protein and hydrocolloid.

Various other coatings are known in the food art, although not all of them are exemplified or suitable as sausage skins. EP-A-0513922 refers to oil-in-water emulsions for cheeses, sausages, fruits, vegetables and flower bulbs having emulsifiers and anti-fungal agents (e.g. natamycin). US 4582710 refers to potato skin substitutes prepared by making a slurry of alginate, caseinate and carrageenan which is spread onto a surface and dried. The resulting film is treated with calcium chloride to strengthen it before being moulded into shells or potato skin shapes to hold moist cooked or mashed potato.

According to a first aspect of the present invention there is therefore provided a generally elongate (e.g. tubular or cylindrical) foodstuff, the foodstuff comprising an edible proteinaceous composition (substantially) encapsulated (or enveloped) by a (hardened) skin comprising a protein and a hydrocolloid.

The combination of the protein and the hydrocolloid can therefore entirely replace the collagen previously used in skins of sausages. These components can together provide desirable physical properties (such as a snapping or cracking sound on breakage) in the (skin of the) foodstuff that collagen has for many years provided. It will therefore follow that the entire foodstuff, namely the proteinaceous composition and/or skin, can be free of meat, meat-derived substances, and in particular, collagen. The replacement of collagen was not straightforward since it provides specific properties in prior art sausages, in particular fast hardening and heat stability: its replacement therefore must not only be food grade but it must replicate most if not all of the properties of collagen. The prior art is testament to previous attempts to replace collagen that have been unsuccessful.

A second aspect of the present invention relates to an edible liquid skin-forming material comprising a protein and a hydrocolloid, the material having a viscosity that allows it to be coated onto and so adhere to a proteinaceous composition to envelop and form a coat around the composition, the coated material being hardenable by chemical or physical means into a hardened edible skin that encapsulates (substantially) the composition.

A third aspect of the present invention relates to a process for the preparation of a

generally elongate (e.g. tubular or cylindrical) foodstuff, the method comprising:

a. coating an edible proteinaceous composition with a liquid skin-forming collagen-free material (such as of the second aspect) comprising a protein and a hydrocolloid to form a liquid coat that envelops the composition; and

b. chemically or physically treating the material (e.g. in situ) to harden the material so that it forms a hardened edible skin (substantially) encapsulating the composition.

The foodstuff may be a sausage. Included within this are German-type sausages (e.g. various würst, saveloy, frankfurters, knackwurst, bockwurst), British-type sausages (e.g breakfast or barbecue sausages) and Italian-type sausages (e.g. salami).

The proteinaceous composition may comprise meat, meat substitutes, plant and/or fish products. Meats include poultry (chicken, turkey), lamb, pork, beef and veal. Plants and plant products can include vegetables such as potato, legumes, nuts, onion, carrot, soy, peas, pulses, beans or cereal or cereal-type products, such as wheat, oats or barley, soy and/or wheat fibres or products derived from any of these vegetables, such as protein. The composition may alternatively or in addition comprise single celled organisms, for example fungi that find use as meat-substitutes which include organisms of the genus *Fusarium* (such products are sold under the name Quorn™) or of the order *Mucorales* as described in the European patent application no. 98307450.1 filed on 15th September 1998 in the name of Gist-Brocades B.V.

The proteinaceous composition may have been (at least partially) cooked or may require cooking (before eating), depending on the type of foodstuff being prepared.

The protein in the skin (or casing) may be milk derived, or lactoproteins, such as casein, whey, vegetable derived, such as soy, cereal derived, for example from maize, corn, wheat, such as gluten, or egg derived (e.g. ovoprotein). Suitably the protein is a non-fibrous one: in some circumstances soy protein may not be used, especially if the hydrocolloid is a polysaccharide such as starch.

The hydrocolloid is preferably a polysaccharide. Suitable hydrocolloids include pectin, pectinate, carrageenan, xanthan, alginate, alginic acid, polygalacturonate, glacturonic acid, galacturonate, mannuronic acid, mannurate, gellan gum and/or carboxymethylcellulose. Carrageenan is less preferred and can be omitted if required.

The skin-forming material is hardenable (e.g. cured, cross-linked or set) by

chemical (which is preferred) or physical means. Chemical means include contact with a hardening, e.g. cross-linking agent a gel-forming agent. Physical means may comprise heating. The material is adapted to be hardened after it has been coated onto the proteinaceous material. Either chemical or physical means can be sufficient, for example there is no need to use physical means (e.g. drying/first before an additional (e.g. chemical) hardening.

The protein may be cross-linkable, and can therefore assist in the hardening. The protein may thus be a heat-sensitive protein, such as one that denatures (or solidifies, or becomes water-insoluble) when heated, for example egg albumin or whey protein. Alternatively or in addition the hydrocolloid can fulfill this role and it is hardenable. Of the two components, it may be more important for some foodstuffs that the hydrocolloid is the hardenable component, although best results have been achieved when both the protein and the hydrocolloid are hardenable (e.g. cross-linkable). Preferably the protein and hydrocolloid will not cross react (with each other).

The hydrocolloid is preferably cross-linkable and/or gellable. It can be hardenable by either chemical or physical means.

Hardening may be by cross-linking that is non-reversible (e.g. physical or covalent linking) or, preferably, by a reversible technique (e.g. ionic linking).

Although the skin-forming material can be subjected to heat, in order to harden it, it is preferred that the hydrocolloid is relatively stable at very high temperatures, and does not decompose, as "off-flavours" or decolouration are usually to be avoided. In this respect, therefore, the hydrocolloid is preferably heat stable at temperatures up to 60°C, for example 80°C, and optimally up to 100°C. Some hydrocolloids may be employed that are heat stable up to 120°C, especially if high temperatures are employed at some stage during the process (for example, sterilization, which will be discussed later). In view of these requirement the material is preferably free of any solid fats, as these have a tendency to melt at higher temperatures, and/or liquid fats which can adversely affect viscosity and coating behaviour.

In some embodiments the skin may initially be wrinkled after hardening. For some foodstuffs, such as those that do not require cooking before consumption, this is desirable. However, for those that do need cooking first the skin is preferably able to become relatively smooth, such as being expandable or contractable, to provide a smooth

outer coat if necessary. The smoothing or expansion of the skin may thus occur during heating, for example on cooking. Thus for some foodstuffs the skin (or casing) can be relatively elastic.

The skin (there is usually only a single layer) should be able to contain (within it) the proteinaceous composition. The composition can thus be in a form whereby it would not retain its shape (over time) if it was not encapsulated or enveloped by the skin. In other words, the skin will often be required for the foodstuff to maintain its desired shape. The (hardened) skin should completely envelop the proteinaceous composition: it should not be sticky or tacky to the touch. Thus the skin should be or feel dry (once hardened) . The skin will not generally be heat-sealable once hardened, as it is intended to be an integral part of the foodstuff rather than edible packaging. This also means that the skin is suitably not soluble in hot water (indeed some foodstuffs may be boiled before consumption).

The skin is preferably (at least partially) elastic or expandable because the foodstuff will often be subjected to heating, such as in pasteurization, sterilization and, for some foodstuffs, cooking. It is preferred that during one or more of these processes the skin remains intact, in other words it does not split or burst. The skin should therefore be relatively strong, and if in a smooth state may be under tension although a wrinkled skin may provide more scope for expansion. The foodstuff will often be consumed with the skin still present: it is not designed to be removed before eating. Thus the skin is usually cellulose-free or free of plastics unlike packaging films.

After hardening the skin it may be subjected to additional processing so that the foodstuff has certain desirable physical characteristics. In some foodstuffs the skin may be relatively brittle. This may allow the skin to break or split if the foodstuff is bent: the foodstuff can be designed to be snapped, e.g. before eating. These properties are particularly desirable in certain types of sausages where the proteinaceous composition is already cooked. Here the breaking or splitting of the skin can result in a snapping or cracking sound which can be characteristic of certain sausages (the so-called "Knäckigkeit").

For other foodstuffs a degree of flexibility is preferred, suitably without breakage of the skin, and in these cases the skin can have an elastic, stretchable or pliable nature.

Before hardening, the skin-forming material may comprise 5 to 25, such as 10 to

20, and optimally from 12 to 18% w/w of the foodstuff. After hardening, this value may fall to be from 2 to 10%, such as from 4 to 9%, optimally from 5 to 7% w/w.

The skin-forming material, that is to say before hardening, may have a water content of from 50 to 95%, such as from 70 to 90%, optimally from 80 to 87%. The skin, produced after hardening, may have a (lower) water content of from 40 to 80%, such as from 50 to 70%, optimally from 50 to 60%.

The foodstuff may have a diameter of from 5 to 150mm, such as from 18 to 80mm, optimally from 10 to 50mm. As will be realised, the skin is relatively thin (e.g. from 0.1 to 2.0mm, optimally from 0.5 to 1.0mm), and so usually does not contribute significantly to the overall diameter of the foodstuff. If therefore the proteinaceous composition is provided in the form of a cylinder or tube, or other elongate form, it may have a diameter within the same range as that specified for the foodstuff. Suitably the length of the foodstuff is at least two, such as at least four, and optimally at least six times its diameter.

The skin is preferably porous so that it allows air and/or water to escape or pass therethrough. This can assist in drying and may avoid the skin bursting if subjected to heat (as water inside the skin will evaporate). The skin may thus allow the foodstuff to "breathe".

The skin-forming material may contain a number of additional ingredients other than just the protein and hydrocolloid. These may include a plasticiser or an anti-spoiling agent such as glycerol (such as from 10 to 20%), potassium sorbate (such as from 1 to 3%), or a preservative or pH-adjusting agent, such as lactic acid. If the skin is to be chemically hardened by a cation then an (e.g. lactic) acid can be included as it can compete for the cation with the hydrocolloid, and therefore (the acid) can be used to adjust the speed or degree of hardening.

Also contemplated are preservatives, such as against bacteria or fungi. An antimicrobial agent can thus be included, such as an antifungal (or anti-microbial) agent (e.g. sorbate, benzoate, especially an alkali metal salt thereof), for example at from 0.1 to 2.0%. A preferred anti-mycotic agent is natamycin: this may be provided at from 0.01 to 0.2% w/w, for example from 0.2 to 0.15, optimally from 0.05 to 0.10% w/w.

The skin-forming material can be white or yellow in colour, a colour in between these hues, or another colour obtainable with the use of one or more colourants. The

appropriate colour can be chosen according to the desired (appearance of the) foodstuff to be obtained. For example, the material may be cream coloured, although this may darken during processing. If not coloured the skin-forming material can be clear, transparent or colourless. This is often preferred if the encapsulated protein composition is to be at least partly visible through the skin.

The material is preferably an aqueous composition, and may be in the form of an emulsion, suspension or slurry. Suitably this will be an oil-in-water emulsion, and may therefore have an oil or fat phase, and an emulsifier. This emulsifier may comprise a protein. Both the aqueous phase and emulsifier may be provided for example by milk, or other milk-derived (dairy) product.

So that the skin-forming material can be coated onto the proteinaceous composition, it is preferably flowable and/or pumpable. It may also be extrudable, since in preferred processes the composition is co-extruded with the skin-forming material.

The proteinaceous composition may additionally contain other edible components, for example flavouring ingredients, flavour enhancers, texture enhancers or components that improve mouthfeel. Thus, included are salt, sugar, herbs, spices etc.

Preferably the protein is present at from 2 to 30%, such as from 5 to 25%, optimally from 8 to 20% by weight (of the skin-forming composition). It is suitably water soluble.

The protein will often provide the skin-forming material with the desired viscosity. The material may be in the form of a paste or thick liquid, especially if it is to be extruded. Preferably the material will thin, in other words have a reduced viscosity, when subjected to increased shear conditions. The viscosity will be sufficient to allow the material to adhere to the composition once it has been coated thereon, and to envelop the composition: these properties are usually required at least until the material has been hardened to form the skin.

The hydrocolloid may be present at from 1 to 5%, such as from 2 to 4%, such as 2.5 to 3.5%. In many applications however the hydrocolloid may be present at from 0.1 to 4.5%. Suitably the ratio of protein:hydrocolloid (by weight) is from 2:1 to 9:1, such as from 3:1 to 7:1.

The skin-forming material is hardened in the process of the present invention. This may be achieved chemically or physically, and if achieved chemically then this can

be by means of a cross-linking or gel-forming agent. This (hardening) agent is suitably provided externally, rather than being present in the proteinaceous composition. This agent may comprise monovalent or polyvalent cations, such as a divalent cation. Suitable cations include calcium, magnesium, iron, zinc, aluminium, sodium, potassium or ammonium. Alkaline earth metal cations, in particular calcium, are preferred. Thus to obtain hardening the skin-forming material may be contacted with a source of the agent such as a desired cation.

The hardening (cross-linking or gel-forming) agent may be provided in a liquid, for example an aqueous liquid. This liquid can be brushed, sprayed, coated or otherwise contacted with the skin-forming material. However, it is preferred that the skin-forming material (when coated on the proteinaceous composition) is dipped, immersed in or passed through, the (e.g. aqueous) liquid comprising the agent. This (aqueous) liquid may thus contain the cations at a concentration of from 1 to 10, such as from 3 to 7, optimally from 4 to 6% (w/w). The aqueous liquid may have a pH of from 3 to 7, such as from 5 to 6. The aqueous liquid will thus act to harden (e.g. coagulate or gel) the skin-forming material so that it forms a skin enveloping the proteinaceous composition. The hardening process may be quite rapid, for example it may take from 0.1 to 10 seconds, such as from 1 to 5 seconds, so it can be almost instantaneous, especially if using contact with a chemical hardening agent.

The hydrocolloid preferably comprises an alginate or alginic acid. Hardening may thus take place using a chemical, e.g. ion exchange, technique. The hydrocolloid when present in the skin-forming material may be water-soluble. However, during the hardening process it may be made water-insoluble or converted to a water-insoluble form. This may be achieved by cation exchange, for example replacing a cation which renders the hydrocolloid water-soluble by a cation which renders it water-insoluble. In particular, one may exchange an alkali metal cation, such as sodium, for an alkaline earth metal cation, such as calcium.

The proteinaceous composition may be provided, or formed into, a shape similar or the same as the eventual foodstuff to be prepared. As will be appreciated, this can be elongate or tubular, for example a cylinder or tube. The composition can then be coated with a skin-forming material. Preferably the composition and/or the skin-forming material are extruded, for example co-extruded, such as simultaneously and/or

continuously. This may provide a particularly efficient process whereby the proteinaceous composition is extruded into an elongate or tubular form: simultaneously the skin-forming material can be extruded, in a fashion whereby it surrounds, encapsulates or coats the proteinaceous composition. Suitable continuous or co-extrusion machines are available from Stork Protocon-Langen B.V., Industrielaan 63, P.O. Box 292, 5340 AG Oss, The Netherlands.

Suitably one can employ a continuous co-extrusion (sausage) machine where the skin-forming material and proteinaceous composition are supplied simultaneously or continuously to a co-extrusion nozzle, so that the material is coated or "spun" onto a continuous or endless tube of the proteinaceous material (suitably of uniform diameter). On leaving the co-extrusion nozzle the then coated proteinaceous material can be subjected to hardening. In particular the then coated proteinaceous composition is immersed or dipped in the aqueous liquid that comprises the chemical hardening (e.g. cross-linking or gel-forming) agent.

The continuous tube that then comprises the coated proteinaceous composition can be transported into the aqueous liquid by a (continuously moving) conveyor or track. This may transport the tube not only into the aqueous liquid, but keep it immersed in the liquid for a desirable time to ensure hardening, and then transport the then-hardened skin containing the proteinaceous composition out of the aqueous liquid.

After hardening the foodstuff can be crimped or cut into the desired shape or lengths. Before or after this the foodstuff can be subjected to heating, sterilization or pasteurization. In addition the foodstuff can be subjected to one or more flavour enhancing techniques, for example one that may result in (new or further) cross-linking, such as aldehyde cross-linking. This may be achieved by contact with an aldehyde, such as in a liquid, which may be sprayed or brushed onto the foodstuff, or the foodstuff may be dipped or immersed in such a liquid. A suitable product known in the art is "liquid smoke". If necessary, the foodstuff may be subjected to cutting, drying, packaging, cooking, canning, freezing, vacuum packing, etc as is known in the art. The foodstuff may be freezable or frozen.

A preferred process of the invention can thus comprise:

(a) optionally, preparing an edible skin-forming liquid collagen-free material comprising a protein and a hydrocolloid, the material having a viscosity that

allows it to be coated onto, and so adhere to, an edible proteinaceous composition;

(b) coating the composition with the skin-forming material so that it forms a liquid coat that envelops the composition, for example by (co-)extruding the material and/or composition;

(c) chemically or physically treating the coat to thereby harden the material so that it forms a hardened skin that (substantially) encapsulates or envelops the composition, such as by contact with a hardening (e.g. gelling or cross-linking) agent that may be present in a liquid into which the material is dipped;

(d) optionally, cutting the resulting product into desired lengths;

(e) drying the product or otherwise reducing the water content, e.g. at a temperature of from 50 to 80°C, such as from 60 to 70°C;

(f) if necessary, (further) cross-linking the protein within the skin, such as by exposure to an aldehyde;

(g) optionally drying again, as mentioned in (e) above;

(h) pasteurising the foodstuff; and

(i) further processing the foodstuff such as by packaging (canning, vacuum packing, etc).

Preferred features of one aspect of the invention are applicable to another aspect, *mutatis mutandis.*

The invention will now be described by way of example, with reference to the following Examples, which are provided for illustration only and are not to be construed as being limiting.

EXAMPLES

Example 1: Preparation of skin-forming material

Sodium caseinate (100g) was dissolved in water (850g). After dissolving and deaeration, potassium sorbate (20g) was added and mixed until completely dissolved. The solution was heated to 80°C and slowly sodium alginate (30g) was added, the mixture being slowly stirred until all components had dissolved. The clear solution was then cooled down (by forced cooling) to ambient temperature.

The solution was transferred into a plastic bucket, closed with a lid, and stored at room temperature until use.

Example 2

Whey protein (200g) was dissolved in water (750g). After dissolving and deaeration potassium sorbate (20g) was added and mixed until completely dissolved. Sodium-alginate (30g) was then added slowly to the solution, and the mixture slowly stirred until all components had dissolved. The clear solution was then force-cooled to ambient temperature.

The solution was transferred into a plastic bucket, closed with a lid, and stored at room temperature until use.

Example 3

The procedure of Example 2 was repeated except that, instead of whey protein, Lucerne protein was used (220g).

Example 4

The procedure of Example 2 was repeated except that instead of whey protein, soy protein was used (180g).

Example 5

The procedure of Example 2 was repeated except that instead of whey protein, wheat gluten was used in the same quantity and sodium pectinate (35g) was substituted

for the alginate.

Example 6

The procedure of Example 2 was repeated except that instead of whey protein, zein (maize) protein was used in the same quantity and a mix of xanthan (10g) and carboxymethyl cellulose (15g) used instead of sodium alginate.

Example 7

The procedure of Example 1 was repeated except that after adding sodium alginate, xanthan (10g) was also added to and dissolved in the mixture.

Example 8

The same procedure of Example 1 was repeated, except that after adding sodium alginate, carboxymethylcellulose (20g) was also added to the mixture and dissolved by stirring.

Example 9

Example 2 was repeated, except that instead of sodium alginate, pectin (40g) was used and stirred in slowly to the mixture.

Example 10

The protocol of Example 2 was followed with the exception that, as an extra step, the mixture was adjusted to pH 5.0 by adding lactic acid, before cooling.

Example 11

The procedure of Example 2 was followed with the exception that after dissolving the whey protein and alginate, sodium chloride was added to give a final amount of 150g per kg of mixture.

Example 12: Manufacture of sausages using skin-forming material

The solution prepared in Example 1 was used to form sausage skins in a continuous co-extrusion sausage making machine produced and marketed by Stork

Protocon-Langen B.V., The Netherlands. The machine employed was a continuous sausage (co-extrusion system) where the sausage filling (or proteinaceous composition) was forced (by a pump) through a circular orifice and so extruded into a tube or cylinder. At this stage the diameter of the proteinaceous composition was 14mm. The skin-forming material (solution from Example 1) was supplied separately via a tube from a pump into a nozzle extruder surrounding the moving tube of edible proteinaceous material. In this way the tube of proteinaceous composition was completely covered by the skin-forming material in a co-extrusion technique.

The tube of coated proteinaceous composition was then passed through a bath containing 5% (w/w) of calcium chloride in water. This was achieved by using a continuously moving track to support the tubular coated composition and transport it into and out of the calcium chloride bath. When the product emerged from the $CaCl_2$ bath the coating of skin-forming material had hardened to form a skin, and the elongate product was then passed to a rotating crimper having a series of jaws that clamped around the continuous product as a drum containing the jaws rotates, thereby crimping and cutting the tube into sausages 10cm in length. The sausages were then dried in a continuous drier, and the skins further hardened with aldehydes using "liquid smoke". The product was dried again, to produce a foodstuff that had a homogenous, well dried skin that completely covered the proteinaceous composition contained inside.

The sausage produced had a relatively brittle and slightly rippled skin, with a firm filler that allowed the sausage to be broken in half or into smaller pieces. The skin made a cracking sound when it split.

Examples 13 to 22

The skin-forming materials of Examples 2 to 11 were all used to make sausages using the same continuous co-extrusion sausage making machine of Example 12. The mixture of Example 10 resulted in sausages having a slightly more flexible skin, because the lactic acid present in the skin competed for the calcium ions in the $CaCl_2$ bath, and so a lesser degree of hardening took place.

CLAIMS

1. A generally elongate foodstuff comprising an edible proteinaceous composition substantially encapsulated by an edible collagen-free skin comprising a protein and a hydrocolloid.

2. A foodstuff as claimed in claim 1 wherein the composition and/or skin is free of meat or animal-derived substances.

3. A foodstuff according to claim 1 or 2 which is extruded, such as a sausage.

4. A foodstuff according to any preceding claim wherein the protein is milk, vegetable or cereal derived and/or the hydrocolloid comprises a polysaccharide.

5. A foodstuff according to any preceding claim wherein the protein comprises casein or whey, soy or wheat protein and/or the hydrocolloid comprises alginate, pectin or carboxymethyl cellulose.

6. A foodstuff according to any preceding claim wherein the skin contains from 50 to 70% water or is from 0.5 to 1.0mm thick.

7. A foodstuff according to any preceding claim wherein the skin is porous, and so allows water or air to pass therethrough.

8. An edible liquid skin-forming collagen-free material comprising a protein and a hydrocolloid, the material having a viscosity that allows it to be coated onto, and so adhere to, a proteinaceous composition to envelop and form a coat around the composition, the coated material being hardenable by chemical or physical means into an edible hardened skin that substantially encapsulates the composition.

9. A material according to claim 8 which on hardening forms an edible collagen-free skin of the foodstuff as defined in any preceding claim.

10. A material according to claim 9 wherein the protein and/or hydrocolloid is cross-linkable.

11. A material according to any of claims 8 to 10 which is extrudable or has a water content of from 70 to 90%.

12. A material according to any of claims 8 to 11 which is hardenable by heating or by contact with a cross-linking or gelling agent.

13. A material according to any of claims 8 to 12 wherein the protein is present at from 2 to 30% (by weight) and/or the hydrocolloid is present at from 1 to 5% (by weight).

14. A process for the preparation of a generally elongate foodstuff, the method comprising:

a. coating an edible proteinaceous composition with a liquid skin-forming collagen-free material comprising a protein and a hydrocolloid to form a liquid coat that envelops the composition; and

b. chemically or physically treating the coat to harden the material so that it forms an edible hardened skin substantially encapsulating the composition.

15. A process according to claim for preparing a foodstuff as defined in any of claims 1 to 7.

16. A process according to claim 14 to 15 which comprises continuously forming a cylindrical tube of the composition which is continuously coated with the skin-forming material.

17. A process according to any of claims 14 to 16 wherein the composition and material are co-extruded and/or the skin is porous.

18. A process according to any of claims 14 to 17 wherein the chemical treatment comprises contact with a gelling or cross-linking agent and/or the physical treatment comprises heating.

19. A process according to any of claims 14 to 18 wherein the chemical treatment comprises immersion of the material in a liquid containing a source of divalent metal cations.

INTERNATIONAL SEARCH REPORT

[redacted] tional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A22C13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A22C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	GB 1 040 770 A (UNILEVER LTD.) 1 September 1966 (1966-09-01) cited in the application page 1, line 68 - line 76; claims 1-20	1-19

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
30 August 1999	06/09/1999

Name and mailing address of the ISA	Authorized officer
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1

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INTERNATIONAL SEARCH REPORT

Inte[redacted]ication No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 5 620 757 A (H. NINOMIYA) 15 April 1997 (1997-04-15) cited in the application column 3, line 44 - column 4, line 5 column 6, line 10 - line 53 column 7, line 34 - column 9, line 17; claims 1-9	1
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A	EP 0 709 030 A (HOECHST AG) 1 May 1996 (1996-05-01) column 2, line 8 - line 56 column 3, line 41 - line 59; claims 1-10	1

1

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